CLAIM(S):

1. A method of fractionating a first proteinaceous material or a second proteinaceous material, the method comprising:

heating the first proteinaceous material to an elevated temperature to yield a third proteinaceous material, the first proteinaceous material comprising κ-casein macropeptide and a heat labile protein, the pH of the first proteinaceous material being greater than about 7, and the elevated temperature effective to polymerize at least some of the heat labile protein present in the first proteinaceous material; or

providing the second proteinaceous material with a pH greater than about 7 to yield the third proteinaceous material, the second proteinaceous material comprising κ-casein macropeptide and the heat labile protein, the temperature of the second proteinaceous material being the elevated temperature, and the elevated temperature effective to polymerize at least some of the heat labile protein present in the second proteinaceous material;

cooling the third proteinaceous material to yield a fourth proteinaceous material; and

passing the fourth proteinaceous material across a filtration membrane to yield a filtration retentate and a filtration permeate, the filtration permeate comprising a majority of the κ-casein macropeptide from the first proteinaceous material or a majority of the κ-casein macropeptide from the second proteinaceous material.

2. The method of claim 1 wherein the heat labile protein comprises (1) β-lactoglobulin, (2) α-lactalbumin, or (3) β-lactoglobulin and α-lactalbumin.

3. The method of claim 2 wherein the fourth proteinaceous material comprises polymers of β-lactoglobulin and α-lactalbumin, the filtration retentate comprising a majority of the polymers of β-lactoglobulin and α-lactalbumin from the third proteinaceous material.

4. The method of claim 1 wherein the κ-casein macropeptide comprises glycomacropeptide.

5. The method of claim 1 wherein the filtration retentate comprises polymerized β-lactoglobulin or polymerized α-lactalbumin.

6. The method of claim 1 wherein the elevated temperature is greater than about 175°F.

7. The method of claim 1 wherein the elevated temperature is at least about 180°F.

8. The method of claim 1 wherein the fourth proteinaceous material has a temperature of less than about 140°F.

9. The method of claim 1, the method further comprising drying the filtration retentate to yield a polymerized protein powder.

10. The method of claim 9 wherein the polymerized protein powder is soluble in an aqueous solution, where about 100 grams of the aqueous solution

includes about 10 grams of the polymerized protein powder and about 90 grams of water, the water having a temperature of about 72°F.

11. The method of claim 10 wherein none of the polymerized protein powder precipitates in the aqueous solution within a period of about one hour after preparation of the aqueous solution.

12. The method of claim 9 wherein an aqueous solution containing about 10 grams of the polymerized protein powder and about 90 grams of water has a Brookfield viscosity of at least about 6,000 centipoise when the temperature of the aqueous solution is about 72°F.

13. The method of claim 12 wherein the aqueous solution has a Brookfield viscosity of at least about 10,000 centipoise when the temperature of the aqueous solution is about 72°F.

14. The method of claim 1 wherein the filtration membrane is a microfiltration membrane

15. The method of claim 1 wherein the filtration membrane has a nominal pore diameter in the range of about 0.02 microns to less than about 0.2 microns.

16. The method of claim 1 wherein the filtration membrane has a nominal pore diameter of about 0.05 microns.

17. The method of claim 1 wherein the filtration membrane has a MWCO greater than approximately 500,000 Daltons and is made of polyvinyl difluoride.

18. The method of claim 1, the method further comprising ultrafiltering the filtration permeate to yield an ultrafiltration retentate and an ultrafiltration permeate, the ultrafiltration retentate comprising a majority of the κ-casein macropeptide from the filtration permeate.

19. The method of claim 18, the method further comprising adjusting the pH of the filtration permeate to a pH ranging from about 5.5 to about 6.5 prior to ultrafiltering the filtration permeate.

20. The method of claim 18, the method further comprising drying the ultrafiltration retentate to yield a κ-casein macropeptide-enriched powder.

21. The method of claim 20 wherein the κ-casein macropeptide-enriched powder is glycomacropeptide-enriched powder.

22. The method of claim 1, the method further comprising drying a derivative of the filtration permeate to yield a κ-casein macropeptide-enriched powder, the concentration of κ-casein macropeptide in the κ-casein macropeptide-enriched powder, based on the total protein weight of the κ-casein macropeptide-enriched powder, being at least about two times greater than the concentration of κ-casein macropeptide in the first proteinaceous material, based on the total protein weight of the first proteinaceous material, or at least about two times greater than the concentration of κ-casein macropeptide in the second proteinaceous material, based on the total protein weight of the second proteinaceous material.

23. The method of claim 1 wherein the first proteinaceous material or the second proteinaceous material comprises glycomacropeptide, the method further comprising drying a derivative of the filtration permeate to yield a glycomacropeptide-enriched powder, the concentration of glycomacropeptide in the glycomacropeptide-enriched powder, based on the total protein weight of the glycomacropeptide-enriched powder, being at least about two times greater than the concentration of glycomacropeptide in the first proteinaceous material, based on the total protein weight of the first proteinaceous material, or at least about two times greater than the concentration of glycomacropeptide in the second proteinaceous material, based on the total protein weight of the second proteinaceous material.

24. The method of claim 1, the method further comprising drying a derivative of the filtration permeate to yield a κ-casein macropeptide-enriched powder, the κ-casein macropeptide-enriched powder comprising at least about 35 weight percent κ-casein macropeptide, based on the total protein weight of the κ-casein macropeptide-enriched powder.

25. The method of claim 1 wherein the first proteinaceous material or the second proteinaceous material comprises glycomacropeptide, the method further comprising drying a derivative of the filtration permeate to yield a glycomacropeptide-enriched powder, the glycomacropeptide-enriched powder comprising at least about 35 weight percent glycomacropeptide, based on the total protein weight of the glycomacropeptide-enriched powder.

26. A method of processing a proteinaceous material, the proteinaceous material comprising κ-casein macropeptide, the method comprising:

polymerizing protein present in the proteinaceous material to yield a proteinaceous intermediate, the proteinaceous intermediate comprising polymerized protein; and

separating the proteinaceous intermediate to yield a first portion and a second portion, the first portion comprising a majority of the κ-casein macropeptide from the proteinaceous material and the second portion comprising a majority of the polymerized protein from the proteinaceous intermediate.

27. The method of claim 26, the method further comprising processing the second portion to yield a polymerized protein powder.

28. The method of claim 27 wherein the polymerized protein powder is soluble in an aqueous solution, where about 100 grams of the aqueous solution includes about 10 grams of the polymerized protein powder and about 90 grams of water, the water having a temperature of about 72°F.

29. The method of claim 27 wherein none of the polymerized protein powder precipitates in the aqueous solution within a period of about one hour after preparation of the aqueous solution.

30. The method of claim 27 wherein an aqueous solution containing about 10 grams of the polymerized protein powder and about 90 grams of water has a Brookfield viscosity of at least about 6,000 centipoise when the temperature of the aqueous solution is about 72°F.

31. The method of claim 30 wherein the aqueous solution has a Brookfield viscosity of at least about 10,000 centipoise when the temperature of the aqueous solution is about 72°F.

32. The method of claim 26, the method further comprising filtering the first portion to yield a filtration retentate and a filtration permeate, the filtration retentate comprising a majority of the κ-casein macropeptide from the proteinaceous material.

33. The method of claim 32, the method further comprising drying the filtration retentate to yield a κ-casein macropeptide-enriched powder.

34. The method of claim 33 wherein the concentration of κ-casein macropeptide in the κ-casein macropeptide-enriched powder, based on the total protein weight of the κ-casein macropeptide-enriched powder, is at least about two times greater than the concentration of κ-casein macropeptide in the proteinaceous material, based on the total protein weight of the proteinaceous material.

35. The method of claim 33 wherein the κ-casein macropeptide-enriched powder comprises at least about 35 weight percent κ-casein macropeptide, based on the total protein weight of the κ-casein macropeptide-enriched powder.

36. The method of claim 26 wherein the proteinaceous material comprises glycomacropeptide, the method further comprising filtering the first portion to yield a filtration retentate and a filtration permeate, the filtration retentate comprising a majority of the glycomacropeptide from the proteinaceous material.

37. The method of claim 36, the method further comprising drying the filtration retentate to yield a glycomacropeptide-enriched powder.

38. The method of claim 37 wherein the concentration of glycomacropeptide in the glycomacropeptide-enriched powder, based on the total protein weight of the glycomacropeptide-enriched powder, is at least about two times greater than the concentration of glycomacropeptide in the proteinaceous material, based on the total protein weight of the proteinaceous material.

39. The method of claim 37 wherein the glycomacropeptide-enriched powder comprises at least about 35 weight percent glycomacropeptide, based on the total protein weight of the glycomacropeptide-enriched powder.

40. The method of claim 26 wherein the proteinaceous material comprises β-lactoglobulin or α-lactalbumin.

41. The method of claim 40 wherein the polymerized protein comprises polymers of β-lactoglobulin and α-lactalbumin.

42. The method of claim 26 wherein the proteinaceous material has a pH greater than about 7.

43. The method of claim 26 wherein the proteinaceous material has a temperature greater than about 175°F.

44. The method of claim 43 wherein the proteinaceous material has a pH greater than about 7.

45. The method of claim 26 wherein the proteinaceous material has a temperature of at least about 180°F.

46. A method of fractionating a proteinaceous material, the proteinaceous material comprising κ-casein macropeptide and heat labile protein, the method comprising:

providing the proteinaceous material with a combination of a pH, an elevated temperature, and a heated holding period that is effective to cause polymerization of at least some of the heat labile protein and yield a proteinaceous intermediate that comprises polymerized protein; and

separating the proteinaceous intermediate to yield a first portion and a second portion, the first portion comprising at least about 80 weight percent of the κ-casein macropeptide from the proteinaceous material and the second portion comprising at least about 80 weight percent of the polymerized protein from the proteinaceous intermediate.

47. The method of claim 46, the method further comprising :

adjusting the elevated temperature and the heated holding period to increase the quantity of κ-casein macropeptide remaining in the proteinaceous intermediate.

48. The method of claim 47 wherein the pH of the proteinaceous material is greater than about 7.

49. The method of claim 46, the method further comprising :

adjusting the elevated temperature and the heated holding period to increase the conversion of heat labile protein to polymerized protein.

50. The method of claim 46 wherein the heat labile protein comprises β-lactoglobulin or α-lactalbumin.

51. A method of fractionating a proteinaceous material, the proteinaceous material comprising κ-casein macropeptide and heat labile protein, the method comprising:

providing the proteinaceous material with a combination of a pH, an elevated temperature, and a heated holding period that is effective to cause polymerization of at least some of the heat labile protein and yield a proteinaceous intermediate that comprises polymerized protein; and

separating the proteinaceous intermediate to yield a first portion and a second portion, the first portion comprising κ-casein macropeptide from the proteinaceous material and the second portion comprising at least about 80 weight percent of the polymerized protein from the proteinaceous intermediate, the first portion and the proteinaceous material, when each subjected to the same reversed-phase high performance liquid chromatography analysis under identical analysis conditions, exhibiting the same, or essentially the same, κ-casein macropeptide profile.

52. A polymerized protein material, the polymerized protein material comprising polymerized β-lactoglobulin or polymerized α-lactalbumin, the polymerized protein material when mixed with water in a ratio of about 10 grams of the polymerized protein material to about 90 grams of water to form an aqueous solution, is soluble in the aqueous solution when the aqueous solution has a temperature of about 72°F.

53. The polymerized protein material of claim 52 wherein the polymerized protein material, when present in the aqueous solution, is effective to prevent any precipitation of the polymerized protein material from the aqueous solution within a period of about one hour after preparation of the aqueous solution.

54. The polymerized protein material of claim 52 wherein the polymerized protein material, when present in the aqueous solution, is effective to provide the aqueous solution with a Brookfield viscosity of at least about 6,000 centipoise when the temperature of the aqueous solution is about 72°F.

55. The polymerized protein material of claim 52 wherein the polymerized protein material, when present in the aqueous solution, is effective to provide the aqueous solution with a Brookfield viscosity of at least about 10,000 centipoise when the temperature of the aqueous solution is about 72°F.

56. A polymerized protein material, the polymerized protein material comprising polymers of β-lactoglobulin and α-lactalbumin, the polymerized protein material, when mixed with water in a ratio of about 10 grams of the polymerized protein material to about 90 grams of water to form an aqueous solution, effective to provide the aqueous solution with a Brookfield viscosity of at least about 6,000 centipoise when the temperature of the aqueous solution is about 72°F.

57. A κ-casein macropeptide-enriched powder, the κ-casein macropeptide-enriched powder comprising protein, the protein comprising β-lactoglobulin or α-lactalbumin and the protein further comprising κ-casein macropeptide, the κ-casein macropeptide-enriched powder having a protein concentration of at least about 75 weight percent, based upon the total weight of the κ-casein macropeptide-enriched powder, the concentration of κ-casein macropeptide in the κ-casein macropeptide-enriched powder being at least about 35 weight percent, based upon the total weight of protein in the κ-casein macropeptide-enriched powder, and the weight ratio of κ-casein macropeptide to the collective weight of β-lactoglobulin and α-lactalbumin in the κ-casein macropeptide-enriched powder being at least about 0.7.

58. The κ-casein macropeptide-enriched powder of claim 57 wherein the weight ratio of κ-casein macropeptide to the collective weight of β-lactoglobulin and α-lactalbumin in the κ-casein macropeptide-enriched powder is at least about 1.

59. The κ-casein macropeptide-enriched powder of claim 57 wherein protein of the κ-casein macropeptide-enriched powder comprises glycomacropeptide, the concentration of glycomacropeptide in the κ-casein macropeptide-enriched powder being at least about 35 weight percent, based upon the total weight of protein in the κ-casein macropeptide-enriched powder, and the weight ratio of glycomacropeptide to the collective weight of β-lactoglobulin and α-lactalbumin in the κ-casein macropeptide-enriched powder being at least about 0.7.

60. The κ-casein macropeptide-enriched powder of claim 59 wherein the weight ratio of glycomacropeptide to the collective weight of β-lactoglobulin and α-lactalbumin in the κ-casein macropeptide-enriched powder is at least about 1.